

Reg.™ A Warner Communications Company

1982
M-WD INC.

BASIC KEYWORDS

| Word | Token | Word | Token |
|----------|-------|----------|-------|
| ABS | 79 | Next | 9 |
| ADR | 67 | NOT | 40 |
| AND | 42 | NOTE | 27 |
| ASC | 64 | ON | 30 |
| ATN | 68 | Open | 23 |
| Bye | 14 | OR | 41 |
| CLOAD | 53 | PADDLE | 8 |
| CHR\$ | 62 | PEEK | 70 |
| CLOG | 76 | PLot | 44 |
| Close | 17 | Point | 28 |
| CLR | 18 | POKE | 31 |
| Color | 3 | POP | 39 |
| COM | 16 | POSition | 45 |
| CONt | 15 | Print | 32 |
| COS | 69 | PTRIG | 83 |
| CSAVE | 52 | Put | 42 |
| Data | 1 | RAD | 33 |
| DEg | 19 | REAd | 34 |
| DIm | 20 | Rem | 0 |
| DOS | 46 | REStore | 35 |
| DRawto | 47 | RETurn | 36 |
| END | 21 | RND | 72 |
| Enter | 5 | RUn | 37 |
| EXP | 74 | Save | 25 |
| For | 8 | SEtcolor | 48 |
| FRE | 73 | SGN | 78 |
| GEt | 41 | SIN | 71 |
| GOSub | 12 | Sound | 50 |
| Goto | 10 | SQR | 77 |
| GRAphics | 43 | STatus | 26 |
| IF | 7 | STEP | 26 |
| Input | 2 | STICK | 82 |
| INT | 80 | STRIG | 84 |
| LEN | 66 | STOP | 38 |
| LEt | 6 | STR\$ | 61 |
| List | 4 | THEN | 27 |
| LOAd | 24 | TO | 15 |
| LOCate | 49 | Trap | 23 |
| LOG | 75 | USR | 63 |
| LPrint | 51 | VAL | 65 |
| NEW | 22 | Xio | 29 |

MUSICAL NOTES

| | | |
|------------|----------|-----|
| high notes | C | 29 |
| | B | 31 |
| | A# or Bb | 33 |
| | A | 35 |
| | G# or Ab | 37 |
| | G | 40 |
| | F# or Gb | 42 |
| | F | 45 |
| | E | 47 |
| | D# or Eb | 50 |
| | D | 53 |
| | C# or Db | 57 |
| | C | 60 |
| | B | 64 |
| | A# or Bb | 68 |
| | A | 72 |
| middle | G# or Ab | 76 |
| | G | 81 |
| | F# or Gb | 85 |
| | F | 91 |
| | E | 96 |
| | D# or Eb | 102 |
| | D | 108 |
| | C# or Db | 114 |
| | C | 121 |
| | B | 128 |
| | A# or Bb | 136 |
| | A | 144 |
| | G# or Ab | 153 |
| | G | 162 |
| | F# or Gb | 173 |
| | F | 182 |
| low notes | E | 193 |
| | D# or Eb | 204 |
| | D | 217 |
| | C# or Db | 230 |
| | C | 243 |

PITCH VALUES

29
31
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81
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91
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144
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243

ERROR MESSAGES

| Code | Message |
|------|---|
| 2 | Memory Insufficient |
| 3 | Value Error |
| 4 | Too Many Variables |
| 5 | String Length Error |
| 6 | Out of Data Error |
| 7 | Number greater than 32767 |
| 8 | Input Statement Error |
| 9 | Array or String DIM Error |
| 10 | Argument Stack Overflow |
| 11 | Floating Point Overflow/Underflow Error |
| 12 | Line Not Found |
| 13 | No Matching FOR Statement |
| 14 | Line Too Long Error |
| 15 | GOSUB or FOR Line Deleted |
| 16 | RETURN Error |
| 17 | Garbage Error |
| 18 | Invalid String Character |

Input/Output Errors

```

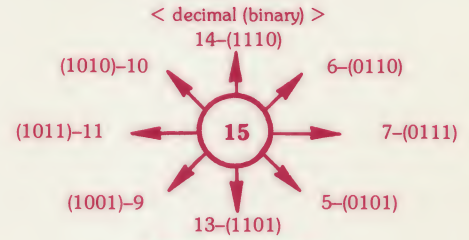
19  LOAD Program Too Long
20  Device Number Larger
21  LOAD File Error
128 BREAK Abort
129 IOCB
130 Nonexistent Device
131 IOCB Write Only
132 Invalid Command
133 Device or File not Open
134 Bad IOCB Number
135 IOCB Read Only Error
136 EOF
137 Truncated Record
138 Device Timeout
139 Device NAK
140 Serial Bus
141 Cursor Out of Range
142 Serial Bus Data Frame Overrun
143 Serial Bus Data Frame Checksum Error
144 Device Done Error
145 Read after Write Compare Error
146 Function not Implemented
147 Insufficient RAM
160 Drive Number Error
161 Too Many OPEN Files
162 Disk Full
163 Unrecoverable System Data I/O Error
164 File Number Mismatch
165 File Name Error
166 POINT Data Length Error
167 File Locked
168 Command Invalid
169 Directory Full
170 File not Found
171 POINT Invalid

```

ATARI HUES

| Value | Color | Value | Color |
|-------|-------------|-------|--------------|
| 0 | Grey | 8 | Blue |
| 1 | Gold | 9 | Light Blue |
| 2 | Orange | 10 | Turquoise |
| 3 | Red-Orange | 11 | Green-Blue |
| 4 | Pink | 12 | Green |
| 5 | Purple | 13 | Yellow-Green |
| 6 | Purple-Blue | 14 | Orange-Green |
| 7 | Blue | 15 | Light Orange |

JOYSTICK



OPERATORS

| highest precedence: | | |
|---------------------|-------|--|
| Token | Oper. | Meaning |
| 50 | < | Relational operators used in string expressions |
| 51 | > | |
| 52 | = | |
| 47 | <= | |
| 49 | >= | |
| 48 | <> | |
| 54 | - | Negation |
| 35 | ^ | Exponentiation |
| 36 | * | Multiplication |
| 39 | / | Division |
| 37 | + | Addition |
| 38 | - | Subtraction |
| 32 | < | Relational operators used in numeric expressions |
| 33 | > | |
| 34 | = | |
| 29 | <= | |
| 31 | >= | |
| 30 | <> | |
| 40 | NOT | Unary Operator |
| 42 | AND | Logical AND |
| 41 | OR | Logical OR |

DEFAULT COLORS

| SETCOLOR register | Color value | Lum value | Color |
|-------------------|-------------|-----------|-----------|
| 0 | 2 | 8 | Orange |
| 1 | 12 | 10 | Green |
| 2 | 9 | 4 | Dark Blue |
| 3 | 4 | 6 | Pink |
| 4 | 0 | 0 | Black |

MODE/COLOR TABLE

| Color | Mode | SETCOL. | COLOR | Application |
|--|--|-----------------------|--|--|
| -- Light Green Dark Blue -- Black | Mode 0 and Text Windows | 0 1 2 3 4 | COLOR deter- mines character plotted | -- Char. Luminance Background -- Border |
| Orange Light Green Dark Blue Red Black | Modes 1 and 2 | 0 1 2 3 4 | COLOR deter- mines character plotted | Character Character Character Character Background, Border |
| Orange Light Green Dark Blue -- Black | Modes 3, 5, & 7 (Four color modes) | 0 1 2 3 4 | 1 2 3 -- 0 | Graphics Point Graphics Point Graphics Point -- Gr. Point, Bkgd., Border |
| Orange -- -- -- Black | Modes 4 & 6 (Two color modes) | 0 1 2 3 4 | 1 -- -- -- 0 | Graphics Point -- -- -- Gr. Point, Bkgd., Border |
| -- Light Green Dark Blue -- Black | Mode 8 1 color and 2 lum. | 0 1 2 3 4 | -- 1 0 -- -- | -- Gr. Point Luminance Gr. Point, Background -- Border |

ADDITIONAL USER NOTES:
(USE PERMANENT MARKER TO PRESERVE)

ANTIC MODES and SCREEN FORMATS

| ANTIC Opcode | BASIC Mode | Char or Bitmap | Number of Colors | X x Y ColumnsxRows | Pixel Size HorxVert | Bytes per Line/Screen |
|--------------|------------|----------------|------------------|--------------------|---------------------|-----------------------|
| \$2 2 | 0 | Char | 2 | 40 x 24 | 8 x 8 | 40/960 |
| \$3 3 | -- | Char | 2 | 40 x 19 | 8 x 10 | 40/760 |
| \$4 4 | -- | Char | 4 | 40 x 24 | 8 x 8 | 40/960 |
| \$5 5 | -- | Char | 4 | 40 x 12 | 8 x 16 | 40/480 |
| \$6 6 | 1 | Char | 5 | 20 x 24 | 16 x 8 | 20/480 |
| \$7 7 | 2 | Char | 5 | 20 x 12 | 16 x 16 | 20/240 |
| \$8 8 | 3 | Bit | 4 | 40 x 24 | 8 x 8 | 10/240 |
| \$9 9 | 4 | Bit | 2 | 80 x 48 | 4 x 4 | 10/480 |
| \$A 10 | 5 | Bit | 4 | 80 x 48 | 4 x 4 | 20/960 |
| \$B 11 | 6 | Bit | 2 | 160 x 96 | 2 x 2 | 20/1920 |
| \$C 12 | -- | Bit | 2 | 160 x 192 | 2 x 1 | 20/3840 |
| \$D 13 | 7 | Bit | 4 | 160 x 96 | 2 x 2 | 40/3840 |
| \$E 14 | -- | Bit | 4 | 160 x 192 | 2 x 1 | 40/7680 |
| \$F 15 | 8 | Bit | 2 | 320 x 192 | 1 x 1 | 40/7680 |

ANTIC BLANK-LINE

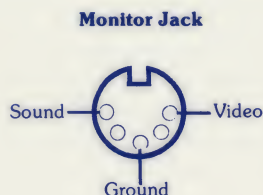
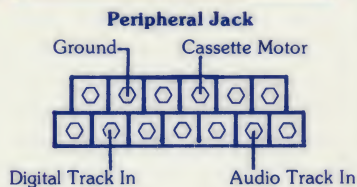
OPCODES

| Number of Blank Lines | Opcode |
|-----------------------|------------|
| 1 | 0 (\$00) |
| 2 | 16 (\$10) |
| 3 | 32 (\$20) |
| 4 | 48 (\$30) |
| 5 | 64 (\$40) |
| 6 | 80 (\$50) |
| 7 | 96 (\$60) |
| 8 | 112 (\$70) |

ANTIC INSTRUCTION MODIFIERS

| Instruction Type | Hor | Vert | LMS | DLI |
|------------------|------------|------------|------------|-------------|
| blank lines | -- | -- | -- | +128 (\$80) |
| char/graphics | +16 (\$10) | +32 (\$20) | +64 (\$40) | +128 (\$80) |
| JMP =1 (\$1) | -- | -- | -- | +128 (\$80) |
| JVB =65 (\$41) | -- | -- | -- | +128 (\$80) |

CONNECTOR PINOUTS



FREE RAM IN PAGE ZERO

| | |
|---------------------|-----------------------|
| 176-202 (\$B0-\$CA) | free in Assembler |
| 203-207 (\$CB-\$CF) | free in BASIC & Assem |
| 208-209 (\$D0-\$D1) | free in BASIC |
| 212-255 (\$D4-\$FF) | free in Assembler |

FREE RAM ELSEWHERE

1536-1791 (\$600-\$6FF), and from value in BASIC MEMTOP, 144,145 (\$90,\$91), to value in OS MEMTOP, 741,742 (\$2E5,\$2E6).

OPERATING SYSTEM ENTRY POINTS

| Label | decimal-Location-hex | Function |
|--------|----------------------|--------------------------|
| DSKINV | 58448 E450 | Disk Handler init |
| DISKV | 58451 E453 | Disk Handler |
| CIOV | 58454 E456 | Central I/O utility |
| SIOV | 58457 E459 | Serial I/O utility |
| SETVBV | 58460 E45C | Set System Timers |
| SYVBV | 58463 E45F | First stage VBLANK |
| XITVBV | 58466 E462 | Exit VBLANK |
| SIOINV | 58469 E465 | SIO utility init |
| SENDEV | 58472 E468 | Send enable |
| INTINV | 58475 E46B | Interrupt Handler init |
| CIOINV | 58478 E46E | CIO utility unit |
| BLKBDV | 58481 E471 | Memo Pad mode |
| WARMSV | 58484 E474 | Warmstart (RESET button) |
| COLDVS | 58487 E477 | Coldstart (power-up) |

FLOATING POINT ROM ENTRY POINTS

| | | |
|--------|------------|--------------------------|
| AFP | 55296 D800 | ASCII to FP conversion |
| FASC | 55526 D8E6 | FP to ASCII conversion |
| IFP | 55722 D9AA | Integer to FP conversion |
| FPI | 55762 D9D2 | FP to Integer conversion |
| ZFRO | 55876 DA44 | Clear FP register 0 |
| ZF1 | 55878 DA46 | Clear FP number |
| FSUB | 55904 DA60 | Floating Point Subtract |
| FADD | 55910 DA66 | Floating Point Add |
| FMUL | 56027 DADB | Floating Point Multiply |
| FDIV | 56104 DB28 | Floating Point Divide |
| PLYEVL | 56640 DD40 | FP Polynomial Evaluation |
| FLDOR | 56713 DD89 | Load FP number |
| FLDOP | 56717 DD8D | Load FP number |
| FLD1R | 56728 DD98 | Load FP number |
| FLD1P | 56732 DD9C | Load FP number |
| FSTOR | 56743 DDA7 | Store FP number |
| FSTOP | 56747 DDAB | Store FP number |
| FMOVE | 56758 DDB6 | Move FP number |
| EXP | 56768 DDC0 | FP Base e Exponentiation |
| EXP10 | 56780 DDCC | FP Base 10 Exp. |
| LOG | 57037 DECD | FP Natural Logarithm |
| LOG10 | 57041 DED1 | FP Common Logarithm |

IMPORTANT MEMORY LOCATIONS---RAM

| Label | decimal-Location-hex | Function |
|-----------|----------------------|---------------------------------------|
| RTCLOCK | 18,19,20 12,13,14 | Internal Clock |
| ICxxxx | 32-47 20-2F | Page Zero IOCB |
| SOUNDR | 65 41 | Noisy I/O flag (0=quiet) |
| ATRACK | 77 4D | Attract Mode flag (128=Attract Mode) |
| LMARGIN | 82 52 | Left Margin (default=2) |
| RMARGIN | 83 53 | Right Margin (default=39) |
| ROWCRS | 84 54 | Current Graphics Cursor Row |
| COLCRS | 85,86 55,56 | Current Graphics Cursor Column |
| CRMODE | 87 57 | BASIC Graphics Mode (0-8) |
| SAVMS | 88,89 58,59 | Lowest Address of Screen Memory |
| OLDROW | 90 5A | Previous Graphics Cursor Row |
| OLDCOL | 91,92 5B,5C | Previous Graphics Cursor Column |
| NEWROW | 96 60 | Row to which DRAWTO will go |
| NEWCOL | 97,98 61,62 | Column to which DRAWTO will go |
| LOMEN | 106 6A | Actual Top of RAM (in pages) |
| VNTPT | 128,129 80,81 | BASIC Low Memory pointer |
| VNTD | 130,131 82,83 | Variable Name Table beginning address |
| VNTD | 132,133 84,85 | Variable Name Table ending address+1 |
| VVTP | 134,135 86,87 | Variable Value Table address |
| STMTAB | 136,137 88,89 | Statement Table address |
| STARP | 140,141 8C,8D | String Array Table address |
| MEMTOP | 144,145 90,91 | BASIC Top of Memory Used pointer |
| STOPLN | 186,187 BA,BB | Line Number of STOP or TRAP |
| ERRSAVE | 195 C3 | Error Number causing STOP or TRAP |
| PTABW | 201 C9 | PRINT Tab Width (default=10) |
| FRO | 212-217 D4-D9 | Floating Point Register 0 |
| FR1 | 212,213 D4,D5 | Value returned by USR function |
| VDSLST | 224,229 E0-E5 | Floating Point Register 1 |
| VBREAK | 512,513 200,201 | Display List Interrupt Vector |
| CDTMV1-5 | 518,519 206,207 | BREAK Vector |
| VVBLKI | 536-545 218-221 | System Timer 1-5 values (low,high) |
| VVBLKD | 546,547 222,223 | Vert. Blank Int. vector (immediate) |
| CDTMA1 | 548,549 224,225 | Vert. Blank Int. vector (deferred) |
| CDTMA2 | 550,551 226,227 | System Timer 1 time-out jump address |
| CDTMF3-5 | 552,553 228,229 | System Timer 2 time-out jump address |
| SDMCTL | 554,6,8 22A,C,E | System Timer 3-5 time-out flags |
| SDLST | 559 22F | DMA enable (0=off) shadow |
| LPENH | 560,561 230,231 | Display List Pointer shadow |
| LPENV | 564 234 | Light Pen Horizontal Position |
| COLDST | 565 235 | Light Pen Vertical Position |
| GPRIOR | 580 244 | 1 = Coldstart on RESET |
| PADDLO-7 | 623 26F | Priority Control shadow |
| STICKO-3 | 624-631 270-277 | Values of Paddle 0-7 |
| STRIGO-3 | 632-635 278-27B | Values of Joystick 0-3 |
| TXTRW | 644-647 284-287 | Joystick Button 0-3 (0=pressed) |
| TXTCOL | 656 290 | Text Cursor Row |
| TXTMSC | 657,658 291,292 | Text Cursor Column |
| BOTSCR | 660,661 294,295 | Top left corner of Text Window |
| PCOLORO-3 | 703 2BF | Number of Text Rows (0,4, or 24) |
| COLORO-4 | 704-707 2C0-2C3 | Color of Player/Missile 0-3 |
| MEMTOP | 708-712 2C4-2C8 | SETCOLOR registers 0-4 |
| MEMLO | 741,742 2E5,2E6 | OS Top of Memory pointer |
| CRSINH | 743,744 2E7,2E8 | OS Bottom of Memory pointer |
| CHACT | 752 2F0 | Cursor Inhibit (0=cursor on) |
| CHBAS | 755 2F3 | Character Mode Register |
| CH | 756 2F4 | Character Set Base Register |
| | 764 2FC | Last Key Pressed (internal code) |

IMPORTANT MEMORY LOCATIONS---HARDWARE REGISTERS

| (XXX) indicates RAM shadow address | W=write | R=read |
|------------------------------------|------------------------|--------------------------------------|
| HPOSP0-3 | 53248-53251 D000-D003 | W-Player 0-3 Horizontal Position |
| M0-3PF | 53248-53251 D000-D003 | R-Missile 0-3/Playfield Collision |
| HPOSM0-3 | 53252-53255 D004-D007 | W-Missile 0-3 Horizontal Position |
| P0-3PF | 53252-53255 D004-D007 | R-Player 0-3/Playfield Collision |
| SIZEP0-3 | 53256-53259 D008-D00B | W-Size of Player 0-3 |
| M0-3PL | 53256-53259 D008-D00B | R-Missile 0-3/Player Collision |
| SIZEM | 53260 D00C | W-Size for Missiles |
| P0-3PL | 53260-53263 D00C-D00F | R-Player 0-3/Player Collision |
| GRAFF0-3 | 53261-53264 D00D-D010 | W-Player 0-3 Graphics Data |
| TRIG0-3 | 53264-53267 D010-D013 | R-(644-647) Joystick Button 0-3 |
| GRAFM | 53265 D011 | W-Graphics for Missiles |
| COLPM0-3 | 53266-53269 D012-D015 | W-(704-707) Player/Missile 0-3 Color |
| COLPF0-3 | 53270-53273 D016-D019 | W-(708-711) Playfield 0-3 Color |
| COLBK | 53274 D01A | W-(712) Background Color & Lum |
| PRIOR | 53275 D01B | W-(623) Priority Control |
| VDELAY | 53276 D01C | W-Vertical Delay |
| GRACLT | 53277 D01D | W-Graphics Control |
| HITCLR | 53278 D01E | W-Clear the Collision Registers |
| CONSOL | 53279 D01F | R-START/SELECT/OPTION Buttons |
| CONSOL | 53279 D01F | W-Click Console Speaker |
| AUDF1-4 | 53760,2,4,6 D200,2,4,6 | W-Audio Channel 1-4 Frequency |
| AUDC1-4 | 53761,3,5,7 D201,3,5,7 | W-Audio Channel 1-4 Control |
| AUDCTL | 53768 D208 | W-Audio Control |
| KBCODE | 53769 D209 | R-(764) Keyboard Code |
| RANDOM | 53770 D20A | R-Random Number Generator |
| PORTA,B | 54016,54017 D300,D301 | Controller Jacks 1 & 2 |
| PA,BCTL | 54018,54019 D302,D303 | Port A and B Control |
| DMACLT | 54272 D400 | W-(559) DMA Control |
| CHACTL | 54273 D401 | W-(755) Character Control |
| DLISTL,H | 54274,54275 D402,D403 | W-(560,561) Display List pointer |
| HSCROL | 54276 D404 | W-Horizontal Scroll value |
| VSCROL | 54277 D405 | W-Vertical Scroll value |
| PMBASE | 54279,54280 D407,D408 | W-Player/Missile Base Address |
| CHBASE | 54281 D409 | W-(756) Character Base Address |
| WSYNC | 54282 D40A | W-Wait for Horizontal Sync |
| VCOUNT | 54283 D40B | R-Vertical Line Counter |
| NMIEN | 54286 D40E | W-NMI Interrupt Enable |